

Name: Ndubuisi Mantelous Chibueze

Department: Electrical/Electronics Engineering

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MAT102 Assignment

- If $A = 2i - j$, $B = 3i + j - 11k$ and $C = 4i + 4j - 5k$. Find the following.

i) $-3A + 7B - 8C$

$$-3(2i - j) + 7(3i + j - 11k) - 8(4i + 4j - 5k)$$

$$-6i + 3j + 21i + 7j - 77k - 32i + 32j - 40k$$

$$= 17i - 22j - 37k$$

ii) If $K = 2A + 4B - C$, find the direction cosine of K .

$$K = 2(2i - j) + 4(3i + 4j - 11k) - (4i + 4j - 5k)$$

$$K = 4i - 2j + 12i + 4j - 44k - 4i - 4j + 5k$$

$$K = 12i - 2j - 39k$$

$$|K| = \sqrt{12^2 + (-2)^2 + (-39)^2} = \sqrt{144 + 4 + 1521}$$

$$|K| = 40.9$$

$$\cos \alpha = \frac{12}{40.9} \quad \cos \beta = \frac{-2}{40.9} \quad \cos \gamma = \frac{-39}{40.9}$$

iii) $(A \times B) \times C = A \times (B \times C)$

i	j	k
3	1	-11
4	4	-5

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$$i \begin{vmatrix} 1 & -11 \\ 4 & -5 \end{vmatrix} - j \begin{vmatrix} 3 & -11 \\ 4 & -5 \end{vmatrix} + k \begin{vmatrix} 3 & 3 \\ 4 & 4 \end{vmatrix}$$

$$i[(1 \times -5) - (4 \times -11)] - j[(3 \times -5) - (11 \times 4)] + k[(3 \times 4) - (4 \times 3)]$$

$$i[-5 + 44] - j[-15 + 44] + k(12 - 12)$$

$$39i - 29j + 0k$$

$$\therefore A \times (B \times C) = \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 39 & -29 & 8 \end{vmatrix}$$

$$i \begin{vmatrix} -1 & 0 \\ -29 & 8 \end{vmatrix} - j \begin{vmatrix} 2 & 0 \\ 39 & 8 \end{vmatrix} + k \begin{vmatrix} 2 & -1 \\ 39 & -29 \end{vmatrix}$$

$$i[(-1 \times 8) - (-29 \times 0)] - j[(2 \times 8) - (39 \times 0)] + k[(2 \times -29) - (-1 \times 39)]$$

$$= 8i - 16j - 19k$$

$$v) A - 2B - C$$

$$2i - j - 2(3i + j - 11k) - (4i + 4j - 5k)$$

$$2i - j - 6i - 2j + 22k - 4i - 4j + 5k$$

$$= -8i - 7j + 27k$$

2. Coplanar Vectors: Three vectors are said to be coplanar if $A \cdot (B \times C) = 0$

Perpendicular Vectors: Two vectors are perpendicular if $A \cdot B = 0$.